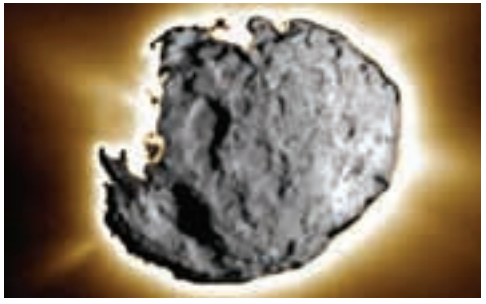
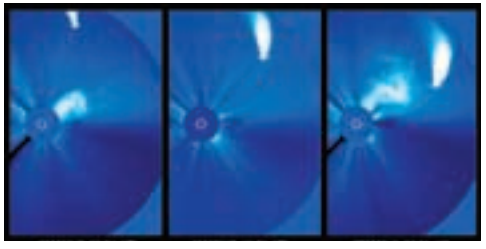
Comets





Comets

Throughout history, people have been both awed and alarmed by comets, perceiving them as "long-haired" stars that appeared in the sky unannounced and unpredictably. To many ancient observers, an elongated comet looked like a fiery sword or some other symbol of death and destruction blazing across the night sky. Chinese astronomers kept extensive records for centuries, including illustrations of characteristic types of tails. As well as noting associated disasters, they recorded the times of cometary appearances and disappearances in addition to celestial positions. These comet annals have proven to be a valuable resource for later astronomers.

We now know that comets are "dirty-ice" leftovers from the dawn of the solar system around 4.6 billion years ago. They are among the least-changed objects and, as such, may yield important clues about the formation of our solar system. Comets may have brought water and organic compounds, the building blocks of life, to the early Earth and other parts of the solar system.

As theorized by astronomer Gerard Kuiper in 1951, a disc-like belt of icy bodies exists just beyond Neptune, where a population of dark comets orbits the Sun in the realm of Pluto. These icy objects occasionally fall towards the Sun and become the so-called short-period comets. Short-period comets take less than 200 years to orbit the Sun, and in many cases their appearance is predictable because they have passed by before.

Less predictable are long-period comets, many of which arrive from a region called the Oort Cloud about 100,000 astronomical units (that is, 100,000 times the distance between Earth and the Sun) from the Sun. These Oort Cloud comets can take as long as 30 million years to complete one trip around the Sun.

Each comet has only a tiny solid part, called a nucleus, often no bigger than a few kilometers across. The nucleus contains icy chunks and frozen gases with bits of embedded rock and dust. At its center, the nucleus may have a small rocky core.

Traveling in a highly elliptical orbit, a comet warms up as it nears the Sun and develops an atmosphere, or coma. The Sun's heat causes ices on the comet's surface to change to gases so that its coma gets larger. This coma may be hundreds of thousands of kilometers in diameter. The pressure of sunlight and high-speed solar particles blow the coma materials away from the Sun, forming the comet's long, and sometimes bright, tails. These tails point away from the Sun's direction.

Most comets travel a safe distance from the Sun — comet Halley comes no closer than 89 million kilometers (55 million miles). However, some comets, called sun-grazers, crash straight into the Sun or get so close that they break up and evaporate.

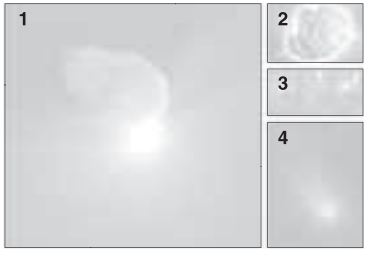
Scientists have long wanted to study comets in some detail, tantalized by the few 1986 images of comet Halley's nucleus. NASA's Deep Space 1 spacecraft flew by comet Borrelly in 2001 and photographed its nucleus, which is about 8 kilometers (5 miles) long. Another NASA mission, called Stardust, was designed to approach a comet, photograph the nucleus, then capture dust samples from the coma and return them to Earth for analysis. Stardust successfully flew within 236 kilometers (147 miles) of the nucleus of Comet Wild 2 (pronounced "Vilt 2") in January 2004, collecting cometary particles as well as interstellar dust particles for a later sample return to Earth.

Another NASA mission, called Deep Impact, consisted of a flyby spacecraft and a small "impactor." In July 2005, the impactor was released into the path of the nucleus of comet Tempel 1 in a planned collision, which vaporized the impactor and ejected massive amounts of fine, powdery material from beneath the comet's surface. A camera on the impactor and two cameras and a spectrometer on the flyby spacecraft showed dramatic brightening that revealed the interior composition and structure of the nucleus.

SIGNIFICANT DATES

1070–1080 — The comet later designated Halley's Comet is pictured in the Bayeux Tapestry, which chronicles the Battle of Hastings of 1066.
1449–1450 — Astronomers make one of the first known efforts to record the paths of comets across the night sky.
1705 — Edmond Halley determines that the comets of 1531, 1607, and 1682 are the same comet and predicts its return in 1758. The comet arrives on schedule and is later named Halley's Comet.
1986 — An international fleet of five spacecraft converges on comet Halley as it makes its regular (about every 76 years) pass through the inner solar system.
1994 — In the first observed planetary impact by a comet, awed scientists watch as fragments of comet Shoemaker–Levy 9 smash into Jupiter's atmosphere.
2001 — Deep Space 1 flies by and photographs comet Borrelly.
2004 — NASA's Stardust spacecraft snaps photos and collects dust samples from comet Wild 2 during the closest-ever flyby of a comet nucleus. The photographs show jets of dust and a rugged, textured surface.
2005 — The Deep Impact impactor collides with comet Tempel 1 to reveal the interior of the nucleus.

ABOUT THE IMAGES



1 The hyperspeed collision of the Deep Impact impactor with comet Tempel 1 generated a huge cloud of dust that reflected sunlight.

2 Stardust revealed the nucleus of comet Wild 2 during a 2004 flyby. Tiny cometary and interstellar dust particles were captured for return to Earth for analysis.

3 The tail of comet C/2001 Q4 (NEAT) expands as it brushes close to a coronal mass ejection from the Sun in 2003.

4 A beautiful cloud of dust and gas surround comet NEAT as it passes through the inner solar system in 2004.

FOR MORE INFORMATION

solarsystem.nasa.gov/planets/profile.cfm?Object=Comets

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